Manganese Nodules: Overcoming the Constraints

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Deepsea Ventures, Inc.
Gloucester Point, Virginia

Abstract This paper discusses the constraints presently inhibiting manganese nodule mining and some developments that could aid in overcoming certain difficulties. The greatest single constraint is economic. With few exceptions, mineral markets are badly depressed. Present projections for development of nodules are for the late 1990s or beyond. However, the United States awarded exploration licenses in mid-1984, and more recently boundaries of license areas have been released. These conditions promote cooperation among organizations engaged in deep-ocean mining. Survey data, and where appropriate some data products, have been exchanged between various consortia. The present hiatus in at-sea activities provides an excellent opportunity to investigate the best means to proceed. This period of quiescence offers a rare moment to distill the meaningful values of the previous era of hectic activity to permit more efficient development in the future.

Background

After initial discovery in the 1870s, manganese nodules languished with little attention with the exception of infrequent, cursory, scientific scrutiny. Little was known of the ocean depth, and most of

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man's mineral needs were derived from continental sources. By the mid-1900s, easily developed deposits had been discovered and many were worked out or were approaching exhaustion. Society had now begun to realize resources were finite, not limitless. It was this perspective that shifted attention to minerals from the sea.

Commercial interest began focusing on nodules in the early 1960s. Despite slow beginnings, advancement proceeded at a record pace. In the last 20 years many nodule deposits have been located, mapped, and evaluated. Commercial interests have centered on the region of the eastern North Pacific between the Clarion and Clipperton fracture zones (C-C Zone). In 1984, the U.S. Department of Commerce issued exploration licenses to four consortia—Ocean Minerals Company (OMCO), Ocean Management, Inc. (OMI), Ocean Mining Associates (OMA), and Kennecott Consortium (KCON) (Fig. 1). Nearly a year later KCON was granted a second license for another area by the United Kingdom.

Now in the mid-1980s a hiatus in activity is evident. Progress, at least for most of the western private sector, has slowed until advancement is very nearly imperceptible. Terms such as "holding pattern" or "data consolidation" are being applied to ocean programs in companies that until recently were aggressively pursuing nodule mining. What brought about the great decline? What is inhibiting further developments? And what can be done to overcome these constraints? The intent of this paper is to discuss these and related matters.

The question, What are the constraints? requires a close look at the reasons for the great decline. The demand for goods and services expanded more or less continuously, with some notable exceptions, in the decades following World War II. The demand for mineral commodities rose steadily. The United States continued the policy of trading agricultural surpluses for mineral commodities largely with the lesser development countries (LDCs) of the world. As the LDCs advanced they consumed larger volumes of their own and each other's mineral products. The competition for copper, nickel, and cobalt drove prices dramatically upward. Indeed, by the late 1960s many nonferrous metals were in short supply and waiting lists were not uncommon. This situation persisted in general until the first oil embargo in 1973. A major shift in global economic
control became apparent and metal markets were soon sharply affected. Poorer nations not only ceased purchasing metals but immediately increased ore production whenever possible. This twofold effect of increase in availability accompanied by decrease in demand drove the market downward. While metal consumption was not altered as radically in developed nations, escalating energy prices and all items on which it impinged forced life-styles to shift to contend with these additional costs. The life-style of affluent nations plunged as their economic influence was further eroded by inflation.

One of the many changes wrought with the slowdown in developments was depressed markets for metals and other mineral products. At the moment inflation appears to be less a problem than in the immediate past, but sustained economic growth is more elusive. This is a thumbnail sketch of the scenario in which deep-ocean mining, or possibly mining itself in its more inclusive sense, is now engulfed.

Mineral commodities across the world are having a hard time claiming or maintaining an equitable market share needed to stabilize the industry. To regain stability obviously requires an increase in demand for ores accompanied by a rise in prices of metals and thus the means to generate and sustain profits. The means to accomplish these ends are not readily achievable; however, there are some suppositions worthy of discussion.

**Constraints**

The constraints inhibiting nodule mining are a mixture of complex factors—economic, technological, sociological, and political. Obviously the boundaries between these various aspects are not precise, and changes in any one can sharply affect the others. Currently mineral markets are badly depressed throughout the Free World. In the case of nodules, it is estimated that commercial mining will not begin for another decade or later. Consumption of copper, cobalt, and nickel are projected to increase only slightly in the next 5 to 10 years. Manganese usage is projected to rise somewhat if steel production can enjoy a modest increase. Advances in steel-making technology have resulted in a decrease in the manganese required per ton of steel produced.
The technology applied in nodule exploration and mining has largely been based on innovative adaptations of existing technology. Microminiaturization of electronic components and devices permitted the development of a succession of remote-sensing instrumentation to probe the deep ocean (e.g., cameras, sonars, and televisions). The need now is not for adaptation of existing devices but for concepts tailored to exploration and mining tools specifically for nodules.

As communication between the various segments of society increases, so does the complex of demands for raw materials. Metals have provided means of sociological advancement. Evolution of a mineral supply-and-demand relationship presently has the consumer nations with little reserves and those with large surpluses with relatively low demand. Moreover, many users are not assured of a stable supply. Clearly, as societies advance in sophistication, consumption of mineral commodities will increase.

Instability of world politics inhibits many pursuits that otherwise would lead to growth in mineral markets. Unfortunately, history notes that consumption of resources is maximized when political/diplomatic processes break down and war ensues. Waste is rampant, resources are squandered. Mineral reserves are insufficient to both provide a reasonable future for mankind and fuel another all-out war. The incentives are great to encourage the nations of the world to indulge in cooperative programs, and to forsake the age-old competition for domination.

Potential Solutions

There are many pressing problems that can influence ocean mining. Losses due to acid rain in terms of forests, aquatic life, crops, and man-made structures run to multibillions of dollars per year (Canada, Ministry of Supply and Services, 1981). Health problems attributed to sulfur and nitrous oxides result in costs estimated in the billions. These pollutants are to a great extent the products of coal-fired furnaces from utilities and other large energy-consuming industries. The concept of nodules as a stack gas absorption medium was identified by Kennecott (Zimmerly, 1967) well over a decade ago.
Oxidation of combustibles is known to be catalyzed by compositions involving transition metals. Elimination of sulfur and nitrogen oxides is possible by catalytic oxidation. However, effective low-cost converters are not currently available. The real need is the ability to retrofit existing coal-burning systems with effective filtration. Nodules extend the possibility of resolving these problems. They possess high specific surface area and are rich in transition metal oxides. These are the prime characteristics of an oxidation catalyst.

Catalytic exhaust systems to reduce automobile emissions are legal requirements in some countries. European countries are now putting legislation in place to deal with both acid rain and engine exhaust emission. In 1980 the U.S. Geological Survey reported platinum to be present in nodules from the Blake Plateau (Charles River Associates, 1979). This is a plus for nodules as an economic answer to the exhaust emission problem. Dr. Paul Weisz of Mobil Research (Weisz, 1968) reported most favorably on this application in 1968: “In all cases the nodule materials, in their natural state, exhibited activities greater than those of commercial oxidation catalysts.”

The use of nodules to absorb sulfur and nitrogen compounds is attractive not only as a way to meet the requirements to control pollution but also as a way to recover metals contained in the nodules. The complex metal oxides in nodules are readily reduced to sulfides as a contaminated gas stream is passed through the filter pack of ground nodules. The Kennecott patent previously mentioned indicates 98% or greater efficiency in removing sulfur dioxide. After the metal oxides are converted to sulfides, well-defined processing techniques can be applied to recover copper, manganese, nickel, cobalt, and possibly several other elements. Ore processing currently is a high-cost item in nodule economic evaluation.

In October 1985 the second Exclusive Economic Zone (EEZ) symposium was sponsored by the Departments of Commerce and Interior. The meeting brought together representatives of government, academia, and industry to plan the exploration and development of this 200-mile zone surrounding the United States and its possessions. This is the largest territorial addition ever acquired by the United States. In order to assess the mineral resources of the
EEZ, cooperative exploration programs are being planned. Definition of the economic potential of the Blake resources is a likely contender for early development.

What is the cost of the endeavors presented herein? Although the price is high to combat air pollution, acid rain, and related hazards, the cost to persist along the present path and take no corrective action is even higher. Life as we know it—forests, aquatic life, wildlife in general, and, yes, our own lives—is at stake. We simply cannot continue to ignore the accumulation of over 27 million tons of sulfur dioxide and 21 million tons of nitrogen oxides emitted in the United States each year (Office of Technology Assessment, 1985). Not only are economic losses and health at stake, international relations are also rapidly deteriorating between us and our neighbor, Canada.

The time to act is now. Even if we sharply reduce air pollution and acid rain, it will still be several years before nature can reverse the trend and the healing of the ecosystem becomes a fact. We are all captives on spaceship Earth, so we should seize the opportunity to enhance the quality of the environment in which we all live. Events have gone full circle, technologist and environmentalist must join forces for the betterment of all. The lowly nodule indeed can contribute to the well-being of society.

Conclusions

This moment of quiescence in mineral developments offers a great opportunity not afforded in periods of hectic development. Simply stated, it is well recognized that the world population is growing explosively and also that we are resource limited. Now is the time to restudy the entire resource problem and plan orderly growth of mineral commodities. Boom and bust is well recorded in the history of mining. Do we have the wisdom to plan effectively and evaluate when demand and prices of minerals will rise again? For it is at this juncture of events that backing to develop new resources will be available.

If the treasure trove of minerals in Africa and South America became inaccessible by virtue of high prices, political reasons, or a possible combination of factors, the need for the four major
metals—manganese, copper, nickel, and cobalt—would quickly rise. Nodules, being an agglomeration of oxides, contain many more elements than those commonly mentioned. Seventy-six elements have been detected in nodules (Haynes et al., 1982). Obviously, the abundance of many of the elements is below present economic interest. Therefore, if one or more of the lesser elements by volume should become a viable by-product, the value of nodules could be increased, first by the product itself and second by possible reduction in processing costs. Even more significant value could be recognized if a compound of elements in the nodule could be marketed.

While gas scrubbing is immediately in focus, other applications will no doubt be realized. As in processing any ore, the more of any compound that is removed, the more concentrated the remaining elements become. With 76 elements identified in nodules, some can be expected to become the subject of secondary recovery when processing systems become better defined.

There is every indication that the research to date extends a promising avenue to resolve several pressing problems. The patents issued to Kennecott on flue gas desulfurization and Mobil Corporation on catalyzing automobile exhaust emissions were disclosed in 1967 and 1968, respectively. In the intervening years, there have been no serious rebuttals to these studies. It is indeed a rare event in modern science, where critical review is encouraged, that some unfavorable commentary is not forthcoming. It should be duly noted that the two organizations are eminently qualified in the given areas of research.

It is hoped that opportunities to fully investigate applications of nodular material to air pollution and acid rain problems will be forthcoming. If such systems prove effective, high-sulfur coal, which we have in abundance, could be burned without the penalty of air pollution or acid rain. Moreover, a domestic source of manganese, nickel, and cobalt could be realized by processing the sulfurized nodule materials. The United States is more than 97% dependent on imports of these commodities. An opportunity to improve environmental quality as well as reduce dependence on imports should not be overlooked. The approach suggested here could prove beneficial on a global scale.
References


1400 - 1630 / 2:00 p.m. to 4:30 p.m.
Room 117

GENERAL SESSION: THE CHANGING FACE OF THE OFFSHORE INDUSTRY—A REGIONAL PERSPECTIVE
Moderator:
William H. Walker, Jr., President, Howard, Wad, LaRouche, Fredricks Inc.
Panelists:
Mike S. Hall, Vice President, Deepwater Holding, Unocal Corp.
James C. Fossey, Vice Chairman and Director, Ocean Energy Inc.
John E. Hull, Chairman and CEO, Chevron Inc.
Peter D. Kirshner, Corporate Vice President and General Manager, FMC Energy Systems Group
Robert E. Ross, Chairman, President, and CEO, Global Marine Inc.

1400 - 1600 / 2:00 p.m. to 4:00 p.m.
Room 106

SEAFLOOR SURVEYS AND PHYSICAL PROPERTIES
Session Chairperson: Bill Gafford, BP Amoco Co. Ltd. and Philippe Joiner, BP Amoco Co. Ltd.
2:00 12103
Comparison of Small Soft-Core Drillings
In the Western Gulf of Mexico Sites With Green (1995) Approach to Geotechnical Exploration
H.T. Roberts, Louisiana State U.
2:22 12104
Geophysical Stratigraphy of Sediments of the Northwest Gulf of Mexico Continental Shelf
2:44 12106
Acoustical Investigation of Near-Surface Gas Hydrate Sediments, the Northwest Continental Shelf
M.P. Squill, U. of Utah; A.G. Figueroado and C. Stall, University of Federal Haemmen; and H.A. Lowy, U. of Utah
3:06 12107
Detailed Site Survey Using VHR 3D Seismic
B. Moroset, J. Mannel, and T. Morset, Bremer, and H. Hols, BRGM
3:28 12108
Acoustic and Alzettal Surveying of Ultra-Submers-Cat Water Bottom (Vmethy) Applications for Both Engineering and Environmental Applications
H.T. Roberts, C. Wilson, and J. Sullan, Louisiana State U.

1400 - 1630 / 2:00 p.m. to 4:30 p.m.
Room 105

NATURAL HYDRATES
Session Chairperson: Arthur J. Schroeder, Consultant and Anis Akin, Texaco

KEYNOTE:
2:00 12112
U.S. Department of Energy Gas-Hydrate Research Initiative: Discussion of Development
E.C. Atkins, Manager of Gas Hydrates and Oil and Gas Diagnostics and Imaging Program, Office of Natural Gas and Petroleum Technology, U.S. DOE
2:22 12114
Variation in Methane Hydrate Structure and Composition
R.B. Coffin and K.S. Kredowski, North Research Laboratory, and J.A. Uster, Y. Thau, Y. Koizumi, P.A. Wenes, and R.D. Docter, Argonne Natl. Laboratory
2:44 12111
Proposal for Ocean Drilling Program Experiments on Gas Hydrates in the Gulf of Mexico
W.W. Sager and M.C. Kennicott, Texas A&M U.
3:06 12115
Global Warming and the World's Oceans: The Manhattan Oceana
G.T. Weisbrod, TSBW Consultants

3:28 12116
Reducing Greenhouse Gas By Ocean
Nourishment
L.S. Jones, U. of Sydney, and H. Young, Earth Ocean and Space
3:50 12110
Dimensional Images From a High-Resolution Underwater Acoustic Imagery
L.S. Jones, U. of Sydney

Room 102

EELF RESEARCH PROJECT: OFFSHORE FACILITIES PRODUCING OIL AT 15,000 FT AND 180°C
Session Chairperson: Pierre-Alain Delaine, Total Fine Eel and Jos Fort, Elf Exploration U.K. plc.
2:00 12117
The Eel/Spimont Project: Developing the Largest High Pressure, High Temperature Fields in the World
J. Fort, Elf Exploration U.K. plc.
2:22 12121
Velocity Anisotropy: Key to Reducing Reservoir Uncertainty at Eel/Spimont Deep High Pressure, High Temperature Field
P. Soxen and G. Robbye, Elf Exploration U.K. plc., and F. Butchard and J. Guedemen, Elf Aquitaine Production
2:44 12120
Completion of Large-Bore High Pressure, High Temperature Wells: Design and Experience
3:06 12122
Equipment and Material Selection to cope With High Pressure, High Temperature Surface Conditions
D. Wolinsky, Elf Exploration U.K. plc.
3:28 12119
Transporting High Temperature Fluids: The Experience From Seminole Basin
3:50 12118
High Pressure/High Temperature Production: Completing the Process Efficiently

Room 100

DEEPWATER DECOMMISSIONING: GARDEN BANKS 388
Session Chairperson: Ray A. Scott, Exxon Corp., and William Strong, COI

2:00 12123
Garden Banks 388 Deepwater Decommissioning: Regulatory Considerations, Issues, and Challenges
M.W. Shaw, Exxon Corp.
2:22 12124
Garden Banks 388 Abandonment—Technical Aspects of Casing and Fishing Operations
2:44 12125
Lessons Learnt: The Free-Standing Production Base
R. Franklin, Exxon Corp., R.J. Herman and T.L. Allen, Cameron, and L. Anderson, Cal Dive Int.
3:06 12126
Subsea Intervention From a No-Scratching-Rig Type Vessel
R. Franklin, Exxon Corp., J. Coffin, Cal Dive Int., and L. Anderson, Cameron
3:28 12127
Flexible/Unibuild Recovery: Garden Banks 388
K. Witherow and A. Jackson, Ocean Accessing Int., and R. Franklin, Exxon Corp.
3:50 12128
60 Days to Success: Critical Program Management
G.A. Scott, Exxon Corp., and K. Duvall, Cal Dive Int.
From: Wellington Lyons
Sent: Wednesday, June 27, 2001 10:18 AM
To: Secretary, The
Subject: Policy

FROM: Wellington Lyons COM
NAME: Wellington Lyons com
SUBJECT: Policy B6
ZIP: B6
CITY:
PARM.1: TO: the.secretary@hq.doe.gov B6
STATE: ME
TOPIC: my concerns with the energy report B6
SUBMIT: Send Comments B6
CONTACT: email B6
COUNTRY: USA
MESSAGE: Good Morning. I am writing to express my utmost indignation and opposition to the Bush Energy Plan. This report shows no concern for the basic human rights of those in oil producing regions, and as the majority of the American Public knows, these rights are very seldom upheld. America does not need more oil that was obtained through any means necessary. What we do need are more fuel efficient cars, better hybrid technology, and economic incentives for the purchasing of more environmentally friendly vehicles. I hope that my comments are included in the public discussion of this report, for they are not out of line with the majority of American voters. Thank you for your time. Sincerely, Wellington Lyons B6

MAILADDR: B6
Dear Mr. Diller:

Thank you for expressing your interest in obtaining information on the Nation's energy policy.

To address the many energy issues facing the Nation, one of President Bush's first acts was to create a National Energy Policy Development Group, headed by Vice President Cheney. This Group was charged with developing recommendations to help the private sector and government at all levels promote reliable, affordable, and environmentally sound energy for America's future. On May 16, 2001, Vice President Cheney sent to the President the recommendations of this group, together with a National Energy Policy report.

The report of the National Energy Policy Development Group describes a comprehensive long-term strategy that uses leading edge technology to produce an integrated energy, environmental and economic policy. The National Energy Policy it proposes follows three basic principles:

- The Policy is a long-term, comprehensive strategy. Our energy crisis has been years in the making, and will take years to put fully behind us.
- The Policy will advance new, environmentally friendly technologies to increase energy supplies and encourage cleaner, more efficient energy use.
- The Policy seeks to raise the living standards of the American people, recognizing that to do so our country must fully integrate its energy, environmental, and economic policies.

To achieve a 21st century quality of life—enhanced by reliable energy and a clean environment—it recommends 105 actions to modernize conservation, modernize our infrastructure, increase our energy supplies, including renewables, accelerate the protection and improvement of our environment, and increase our energy security.

The President has already taken actions to implement many of the report's recommendations. Over the coming months, further actions will be taken by the President, individual Federal agencies and the Congress. These actions, once
fully implemented, will help minimize future energy prices, while assuring that energy supplies are reliable and the environment is protected.

A full copy of the National Energy Policy report, with the specific recommendations to the President, is available on the White House webpage, www.whitehouse.gov, or on the webpage of the Department of Energy, www.energy.gov/HOPress/releases01/maypr/energy_policy.htm

This report provides a wealth of information on the energy problems facing the nations and on the actions of the Federal government. Much more information is available through the Department of Energy’s web page, www.energy.gov.

I hope this information is helpful. Thank you for writing.

Sincerely,

Margot Anderson
Deputy Assistant Secretary
Office of Policy
and International Affairs
Ms. Dorothy L. Dooley

Dear Ms. Dooley:

Thank you for your letter of February 12, 2001, to President Bush that expressed your concerns about rising energy costs and requested help in lowering these costs. In particular you asked for the name of the office, Department or person that you might contact to get help for senior citizens who might be harmed if electricity rates increased as much as had been predicted earlier this year.

First, I would like to apologize for the lengthy delay in responding to your letter. The White House and the Department of Energy have received thousands of letters expressing concerns about rising energy costs and it has been impossible to provide timely responses to most of these letters.

In your letter you indicated that you had contacted Mr. Robert Carolin, the manager of the local irrigation project, operated by the Bureau of Indian Affairs, that provides electricity to your area. He and his superiors in the U.S. Department of the Interior are the appropriate persons to contact about such concerns.

Because the Irrigation Project buys electricity from other producers, I understand that it was forced to pass on some of the rising costs of these purchases to its customers. Early this year customers were informed that these rate increases might be as high as 300 percent, which understandably caused considerable concern in your community.

Mr. Carolin has indicated to this office that the actual increases in residential rates were approximately 28 percent, which brought these rates to the same level that is typical for most other residential users in Arizona. During the winter and spring, when purchased electricity costs were unusually high, the Irrigation Project was able to avoid even larger rate increases by using reserve funds provided by the U.S. Department of Interior. Now that its electricity purchase costs have returned to normal levels, I understand that the Irrigation Project hopes to be able to maintain or even lower electricity rates, while not relying on additional supplemental funding from the Interior Department.

To address the many energy issues facing the Nation, one of President Bush's first acts was to create a National Energy Policy Development Group, headed by Vice President Cheney. On May 16, Vice President Cheney sent to the President

Department of Energy
Washington, DC 20585

July 30, 2001
the recommendations of this group, together with a National Energy Policy report. To achieve a 21st century quality of life – enhanced by reliable energy and a clean environment – the report recommends 105 actions to modernize conservation, modernize our infrastructure, increase our energy supplies, including renewables, accelerate the protection and improvement of our environment, and increase our energy security. Once these actions have been fully implemented by the Congress and Federal agencies, they will help minimize future energy prices, while assuring that energy supplies are reliable and the environment is protected.

In order to help consumers cope with the higher energy prices they face now, the President supports existing Federal and state efforts to help energy users conserve energy and has proposed increased funding for Federal programs that help low income households. Information on ways to reduce energy costs by improving energy efficiency is available from the U.S. Department of Energy and many state governments. You can contact the Department's toll-free clearinghouse for information or referrals at (800) DOE-3732 (800-363-3732) or you can visit the Department of Energy's website: www.energy.gov

Low-income households may be eligible for direct assistance in weatherizing their homes or in paying energy bills. Eligibility for the Department of Energy's Weatherization Assistance Program or the Department of Health and Human Service's Low-Income Home Energy Assistance Program (LIHEAP) can be obtained through the toll-free clearinghouse number or website identified above. You may also get information on LIHEAP by going to the internet website at www.acf.dhhs.gov/programs/liheap.

I hope this information is helpful.

Sincerely,

Margot Anderson
Deputy Assistant Secretary
Office of Policy
and International Affairs

Obtained and made public by the Natural Resources Defense Council, May 2002
MEMORANDUM FOR Mr. LÁKE BARRETT  
Acting Director, Office of Civilian Radioactive  
Waste Management

This memorandum requests an extension of the nonreimbursable detail of Charles M. Smith to the National Energy Policy Development Group, Office of the Vice President, through October 31, 2001. His detail is currently effective through August 31, 2001.

Mr. Smith remains assigned as a Senior Professional Staff member to the National Energy Policy Development Group.

He continues to be responsible for assisting in the implementation of the recommendations contained in the President's National Energy Policy Report.

I appreciate your timely attention to this request.

Andrew Lundquist  
Executive Director  
National Energy Policy Development Group
3 August 2001

To: Representative Secretary

Re: Policy - Decision Criteria

Dear Representative Secretary:

Before defining our policy, we need to test at least the major alternatives against some useful criteria. Key criteria could be Security, Sustainability, Environment, Economics, Ethics, and Morals. There are other possibilities, including politics and campaign financing, but these six are surely the most important. Note: The NEPDG does not even mention high-level criteria. Rather, it represents the shaping of policy in a vacuum.

Security
Consider that the USA has only 86 Gb (33%) left, of its originally estimated 260 Gb of ultimately recoverable oil. (Some experts believe it may be more like 50 out of 225). We can rush into a major and costly domestic supply side campaign, and deplete that remaining resource more quickly, or we can address the demand side and keep that resource well into the future as a reserve against unforeseeable contingencies. A US Army tank gets 0.5 mpg. What if we have to fight a war some time in the next three decades, and find tanker routes imperiled? Maybe we should maintain a serious domestic strategic reserve.

Also relative to ANWR, what can be less secure than our present Alaska pipeline, which the US military has described as indefensible, and which is already old enough and worn enough to pose significant maintenance issues?

Nuclear not only poses security risks from the point of view of potential bomb fuel and radioactive waste, but also from supply interruption. We import 90% of our fuel.

On the other hand, both energy efficiency and renewable energy resources are diffused throughout the nation, have no attackable choke points, are 100% domestic, and will not run out.

Sustainability
Any supply side source, other than renewables, is useable only once and ultimately runs out. Energy savings, once implemented, are exploitable forever after. Wind and solar are available as long as the wind shall blow and the sun shall shine. How can it make sense to use energy and capital to build rigs and drill holes (many of them dry) when the same money could build wind turbines that never result in dry holes and provide energy year after year?

There is also the question of climate change. Even if there is still uncertainty, why take the risk of catastrophic consequences when we have

Obtained and made public by the Natural Resources Defense Council, May 2002
excellent alternative choices?

All fossil fuels add CO2 and other emissions to our atmosphere. Coal is worst, and coal to replace scarce oil is three times worse than the oil it would replace. Energy efficiency can eliminate the need to replace oil without any emissions. Renewables can replace coal without any emissions.

If we continue to waste our fossil fuel resources, burning them to fuel inefficient ends, we deprive future generations of potentially much more valuable chemicals and fertilizers that could sustain many aspects of their lives, including food production. If we deplete the fuels before we build the wind turbines and photovoltaic arrays, we may not have the energy with which to build them.

We must not choose an unsustainable path, when a sustainable one is both more readily available and more economically attractive.

Environment
Apart from the debatable environmental questions of global warming and climate change, there are other serious environmental issues associated with fossil fuels. The primary ones are air quality and associated health issues. Others range from the local environmental devastation of strip mining (coal and tar sands) through pollution of aquifers to storage of nuclear waste and spent fuel. Many of the problems are extremely long lasting once created.

The only environmental issue seriously raised relative to wind is bird-kill, and with new large, slowly revolving turbines, that proves to be a non-issue. Photovoltaics, located on rooftops and in parking lots, can actually provide the environmental benefit of shade, reducing the very energy demand they are there to serve. Energy efficiency, by reducing both waste and energy needs, alleviates environmental problems.

Economics
There are too many aspects to this issue, nearly all favorable to efficiency and renewables, and unfavorable to fossil and nuclear, to deal with in a short paragraph. Just to note a few:
* Efficiency opportunities typically cost from 0.6¢ to 2¢ per KWh. Natural gas and coal impose costs greater than 3¢/KWh and nuclear, fully costed, is above 6¢/KWh.
* Wind is already as cheap as natural gas and coal, and costs are still dropping for wind, but will only rise for natural gas and coal.
* Importing fuel presents a major balance of payments burden, and developing new domestic oil supplies has a much higher associated cost than importing.
* Drilling the ANWR does not make economic sense, even at today’s oil cost. No oil company is ready to jump in without subsidies and market guarantees. Every excess dollar spent on costly ANWR oil is a dollar not available for efficiency and renewables, resulting in more imports that could have been avoided, and worsening the balance of payments issue.
* Excess dollars spent on nuclear are even more deleterious, as we also import the fuel.

Ethics
The USA fought a Revolutionary War over taxation without representation. If we continue to imperil the energetic fate of future generations, without developing viable alternatives, we in effect impose a major tax, and future generations are clearly not represented in the decisions. We have an ethical imperative to safeguard their rights. Wantonly depleting the last of a valuable resource is totally contrary to that imperative.

The nuclear industry may claim to safeguard the energy future, but they
impose the problems of current pollution (from mining, milling, and concentrating) on our suppliers, as well as the problems of radioactive waste on future generations for thousands of years.

Efficiency and renewables avoid all such issues.

Morality
As the acknowledged world leader both economically and militarily, (and most of us would like to think socially and politically), we have a moral duty to aid the development of our less fortunate brethren worldwide—not to increase their difficulties. Consuming fuels that they will need in the future as feedstock for chemicals, pharmaceuticals, and agriculture is contrary to this duty.

Developing the technologies of efficiency and renewables, creating the market volume to lower costs, and easing their access to such technologies so they do not have to repeat our wasteful history fulfills our duty.

The above examples present only a very limited and qualitative introduction to the evaluation of strategic criteria. Brief reflection on anyone's part can more fully flesh out the arguments. However, even from this truncated exposition it is clear that the hydrocarbon/nuclear supply side approach fails all reasonable criteria, while the energy efficiency/renewables approach passes the test of every criterion. An extensive and quantified evaluation would make the case compellingly and irrefutably.

If the case is so clearly made, based on a reasonable evaluation against primary criteria, why has it escaped the NEPDG? There are at least three reasons:

* It is human nature to put narrow, concrete self-interest ahead of compelling but less tangible national and spiritual values.
* The members of the NEPDG represent only a very narrow spectrum of interests, and are both providers and victims of disinformation.
* There are major economic interests involved.

It is interesting to note that of 63 energy advisors selected by the present administration, nearly all of them represent the constituencies that stand to benefit the most from the emphases apparent in the NEPDG report, i.e. 27 are from the oil and gas industry, 17 from nuclear, 16 from mainly coal-fired electric utilities, and 7 from the coal industry. There are no renewable industry representatives, and no experts on the practical opportunities for energy efficiency.

A good national energy policy will require inputs from a much broader group of experts, including national security analysts, ethicists, environmentalists, neutral economists, and, most importantly, renewables and efficiency experts.

Respectfully yours,

Murray Duffin

MD/mmb
August 3, 2001

Secretary Abraham
Department of Energy
Washington, D.C.

Dear Secretary Abraham:

From what I have read in the newspapers, it appears that President Bush's energy policy will be an energy production policy. What ever happened to conservation?

The latest offerings from The U. S. automakers in Detroit are gas-guzzling SUV's. How about a 10% or $5000 tax on these environmental hogs?

I am also disappointed that AMtrak is cutting service rather than improving it. How come France is in the technological forefront in rapid transit? Their high speed train from Paris to Nice just cut travel time by an hour. There are plenty of rail corridors between population centers in this country that could support a high-speed train. Why don't we support rapid rail transit instead of wasting money in our overcrowded airports?

Sincerely,

Roger W. Robert

Roger W. Robert
Dear Mr. Vice President,

Attached is one more letter to the House and Senate. As you can see, the best policy priorities for the country differ substantially from those just passed by the House. I live in hope that, in the end, wiser heads will prevail.

Respectfully yours,
Murray Duffin
THE ENERGY CHALLENGE - XIV

6 August, 2001

To: Representative Secretary

Re: Policy priorities

Dear Representative Secretary

A summary of the key points made in prior letters will point to the main priorities. In bullet form the most important issues are (not in order of importance):

Premises
- Oil will be in decline worldwide by 2010, and out of the energy picture before 2050.
- America's oil will decline faster than world average due to loss of market share.
- Natural gas supply will fall short of 2020 demand projections, and will be in decline before 2030, with the risk of abrupt decline at some point.
- Because of the above, the energy policy time horizon must be 30 to 50 years.
- Natural gas cannot be imported from distant points economically or in enough volume to offset national shortages.
- Nuclear is not desirable, not cheap and not necessary. Negatives outweigh positives.
- Coal is abundant and cheap, but dirty and producing CO2. Clean technology needs R&D.
- Reducing energy intensity, (conservation and efficiency), is the quick, low cost way to reduce foreign dependence.
- Reducing energy intensity creates jobs, saves money and helps payments balance, benefiting the economy.

Promises
- Wind is abundant, clean and already cheap, but calls for infrastructure development.
- Solar is more abundant and will become cheap with development and economies of scale, but requires storage and major development of manufacturing capacity.
- Geothermal may be abundant but needs R&D to tap and develop effectively.
- Wave and tidal are abundant, but not yet practical. Much R&D needed.
- There is vast room to practice energy economies. See Europe/Japan energy intensities.
- 68 quads of present oil, natural gas and nuclear can be replaced by 27 quads of renewably generated primary electricity over time, due to relative economic productivities.
- Hydrogen is the key to mobility and storage and transport of renewably generated energy.

Problems
- Hydrogen generating costs still have to come down, and storage needs development.
* Natural gas pipelines need upgrading for hydrogen transport.
* Evolution from hydrocarbon to hydrogen economy, including wind/solar ramp-up, needs decades, so must to start now.
* Barriers - Ignorance of threats, needs and possibilities.
  - Special interests that promote their good at the expense of public good.
  - Economic models/analyses that give wrong answers from wrong premises.
  - Perverse incentives and disincentives in the present politico/economic system.
* Transition from fossil/nuclear/wasteful to renewable/hydrogen/efficient will be resisted by the "frogs" at every step.

Needs
* Public knowledge of the threats and opportunities and means of effecting energy efficiencies and savings, i.e. a publicity and education program.
* Regulatory reform to promote "megawatts" instead of megawatts.
* A new system of incentives, - standards, "fee-bates", tax the "bads" reward the "goods"

Priorities
  From the above, based on the timing, seriousness and nature of the threats and opportunities, we can identify a few key priorities and appropriate actions, in order of importance.
* Oil is the first problem, and is used more than 80% for transportation. There is no supply side solution. Therefore the first priority is transportation efficiency. The first 5 actions:
  - close the light truck CAFE loophole for all but the 5% that are legitimate light trucks
  - raise CAFE standards to 40 mpg by 2010 and 80 mpg by 2030
  - provide surcharges for inefficiency at the gas pump as well as licensing
  - support development of clean, efficient trucks and busses
  - encourage and promote development of urban rapid transit.
* Next is the shortage of natural gas, with new demand primarily for electricity generation. The available natural gas must be used as efficiently as possible:
  - favor licensing of combined heat and power (CHP) plants, target 70%+ efficiencies.
  - refuse licences for plants less than 50% efficient
  - replace old inefficient coal plants with new BAT coal plants to reduce gas demand.
  - deregulate utilities to favor promotion of efficiency over expansion.
  - provide tax incentives for energy efficiency materials, equipment and projects.
* Third, reduce dependence on imported energy through both efficiency and renewables:
  - provide promotion, education and incentives in support of efficiency
  - establish office and residential building standards enforced by a "fee-bate" system
  - set efficiency standards for utilities to reduce primary fossil/nuclear energy per kWh delivered, and gradually raise the bar
  - incentivize wind farm growth to 30,000 MW per year by 2010, and support the necessary distribution system developments
  - incentivize development of at least 20 large solar PV plants by 2010
  - negotiate voluntary efficiency improvement agreements with industry sectors
  - raise taxes on inefficiencies - motors, appliances, HVAC, lighting etc.
* Protect, not accelerate depletion of, our remaining domestic oil and natural gas resources, both as a hedge against future emergencies, and as chemical and agricultural feedstock. Aligned with this priority is the need to avoid destabilization of the Middle-east. As non Middle-east supplies decline first, we can reconcile these 3 apparently conflicting priorities, without harming our allies, by letting non-OPEC supplies decline in line with declining availability, while not reducing supplies from the Middle-east below what they can readily sell to other markets. A delicate
balancing act will be required, that an unhindered free market may not be able to achieve.

* Review and improve the conduct of regulation at the federal level:
- no more cabinet level second-guessing of correct penalties for flagrant and chronic violations by large electric utility corporations
- no more regulatory derelictions like classifying the Daimler-Chrysler PT Cruiser as a light truck.
* Take a leading role in CO2 reductions. After all the above the only problem is coal:
- support rapid development of clean coal technology
- create a carbon emissions trading scheme analogous to the Clean Air Act SO2 scheme
- set progressively tighter CO2/kWh goals for utilities.

References
There are several good sources that provide detailed proposals to implement various aspects of the above-suggested actions:
* www.aceee.org/energy/hep0501.htm for proposals in support of energy efficiency
* www.tcorp.com/nha/implan.htm and www.tcorp.com/nha/h2bill96.htm for elements of a hydrogen policy

Conclusion
It is not necessary to address all aspects of the above priorities and actions before rolling out a good first-cut National Energy Policy, but they should be recognized, and must be addressed eventually. The most important and potentially productive ones should be addressed first. The policy can then be developed over time as events unroll and experience is gained.

Perhaps the most critical needs are to ensure that policy is not dictated or excessively influenced by the coal, oil, gas, nuclear and automotive industries, and to be sure we have "seen most of the elephant", not just the above interested parties' view.

The Sustainable Energy Coalition, who were consulted and whose inputs were largely ignored by the NEPDG, have characterized the NEPDG report as a disaster for America. The energy bill just passed by the house largely reflects the NEPDG report, and is to a considerable degree antithetical to our true energy policy needs. Regrettably this first pass at dealing with the most important non-partisan challenge this country is likely to face in this decade was railroaded through in a completely partisan fashion.

This issue is above partisan politics and narrow commercial interests. It calls for deliberation and wisdom, not political one-upmanship. You, our elected leaders, are going to have to do an awful lot better as we progress down this road, or you will end up doing a great disservice to America.

Sincerely yours,

Murray Duffin

Obtained and made public by the Natural Resources Defense Council, May 2002